

The Elegance of Enigma: Quantum Darwinism, Quantum Bayesianism (QBism) & Quantum Buddhism – In Pursuit of a (Quantum) Middle Way!

Graham P. Smetham*

Abstract

Quantum Bayesianism or QBism is a new approach to quantum interpretation which offers a radically subjectivist and pan-experientialist account of the functioning of quantum ‘reality’ and the emergence of the ‘classical’ world. In a recent collection of essays *Elegance and Enigma: The Quantum Interviews* there is a debate between one of the supporters of the QBism paradigm, C. A. Fuchs, and the instigator of ‘quantum Darwinism’, W. Zurek, as to the viability of such a radically subjectivist position. Zurek suggests that the ‘many worlds’ interpretation and the QBism perspectives are extreme views and his perspective steers a ‘middle way’ between the two. In this article I show that an almost identical metaphysical debate occurred in fourteenth and fifteenth Tibetan Buddhism concerning the nature of ultimate reality. The two debates are examined, contrasted and the conclusion that it may be the case that quantum reality may be describable in differing complementary and interrelated ways is drawn.

Keywords: Quantum Bayesianism, QBism, Quantum Darwinism, Quantum Buddhism, epiontic paradigm, many worlds interpretation, subjectivism, Fuchs, Zurek, ‘extreme views’, Madhyamaka, ‘middle way’, Yogacara-Cittamatra, Mind-Only, Emptiness, Tsongkhapa, Gorampa, Dolpopa.

There is yet another new approach to understanding the nature of quantum theory, an approach which according to one of its ardent proponents Christopher A. Fuchs allows “no room for most of the standard year-after-year quantum mysteries.”¹ ‘Quantum Bayesianism’ generally refers to a viewpoint on the nature of ‘quantum states’ developed by C. M. Caves, C. A. Fuchs and R. Schack, the version which will be considered in this paper is that presented by Fuchs under the catchy rubric of ‘QBism’. The core perspective adopted by Quantum Bayesianism and QBism (as we shall be concerned with the work of Fuchs the term ‘QBism’ will be used henceforth) is that the probabilities which are usually associated with a ‘quantum state’ are entirely subjective and are not therefore, in reality so to speak, connected with anything in an external or underlying quantum realm. Thus the second section of Fuchs’s paper ‘QBism, the Perimeter of Quantum Bayesianism’ is headed ‘Quantum States Do Not Exist’, and therein Fuchs tells us that:

The world may be full of stuff and things of all kinds, but among all the stuff and all the things, there is no observer independent, quantum-state kind of stuff.²

So it appears, then, that Fuchs’s position lays down a gauntlet for a few of his colleagues such as Wojciech Zurek who has declared that:

* Correspondence: Graham Smetham, <http://www.quantumbuddhism.com> E-mail: graham@quantumbuddhism.com

...quantum states, by their very nature share an epistemological and ontological role – are simultaneously a description of the state, and the ‘dream stuff is made of.’ One might say that they are *epiontic*. These two aspects may seem contradictory, but at least in the quantum setting, there is a union of these two functions.³

Zurek’s putative type of ‘quantum state’ may be comprised of epiontic ‘dream stuff’ but presumably this kind of stuff must be hovering on the edge of existence, however ghostly its essence may be!

However, it is important not to be too hasty in drawing conclusions, for the last paragraph of Fuchs’s above mentioned paper tells us that the QBism research program:

...hints of a world, a pluriverse, that consists of an all-pervading “pure experience,” as William James called it. Expanding this notion, making it technical, and letting its insights tinker with spacetime itself is the better part of future work. Quantum states, QBism declares, are not the stuff of the world, but quantum *measurement* might be. Might a one-day future Shakespeare write with honesty,

Our revels are now ended. These our actors,
As I foretold you, were all spirits and
Are melted into air, into thin air . . .
We are such stuff as
quantum measurement is made on.

As we all know the final line in the original is “We are such stuff as dreams are made on,” so it would seem that the kind of quantum stuff dreamt of by Zurek and quantum non-stuff conjured up by Fuchs should have some sort of connection. In fact if Fuchs really wants to stick with his Shakespearian modification it would follow that quantum measurement is actually made on some kind of ‘stuff.’ It is quite clear that in this area of thought we are in a quantum conceptual field of fine distinction and exquisite knife edge balance of implication, a situation which has existed since Bohr originally tried to meld together the apparently antithetical realms of the ‘quantum’ and ‘classical’ domains.

It will probably come as a surprise to many physicists to be told that similar, in fact in some respects identical, debates concerning the ‘ultimate’ nature of reality were central within the development of Mahayana (Great Vehicle) Buddhist metaphysical philosophy, starting some two thousand years ago with the great Buddhist philosopher Nagarjuna (2nd century) who elucidated the central Madhyamaka (Buddhist ‘Middle Way’) concept of *shunyata* or ‘emptiness’. This metaphysical perspective asserts that all phenomena lack ‘inherent existence’ or they do not exist ‘from their own side’. One metaphor often used in this context is that of dream-like phenomena; thus in discussing the nature of agents and the results of actions by apparent agents Nagarjuna asserted that:

The agent and the results ... are all ... like an illusion, and like a dream.⁴

And Nagarjuna, the founder of the Madhyamaka metaphysical analysis, in his remarkable work *Mulamadhyamakakarika* (Fundamental Verses on the Middle Way) shows that this metaphysical condition, the lack of ‘inherent existence’ (*svabhava*) or the lack of independent internal essence, applies to all phenomena:

They are without nature, just like space,
But since they come about due to mere dependent origination,
They are not utterly nonexistent,

Similar to cause and effect in dreams.⁵

It is this essential lack of independent and self-enclosed ontological essence in all phenomena which is given the term ‘emptiness’ (*shunyata*) in Madhyamaka Buddhism. Another observation that follows from the fact of emptiness that Nagarjuna made concerns the ‘reality’ of phenomena:

Everything is real and not real,
Both real and not real,
Neither real nor not real...⁶

In Madhyamaka philosophy terms are always used with precision, a situation which unfortunately is not always the case in quantum debates wherein, of course, the mathematics will be precise and rigorous but often terms like ‘real’ or ‘existence’ are used with everyday imprecision. The term ‘real’ within Madhyamaka means that an entity is a final, ultimate, fixed, eternal and absolute aspect of reality. So using the term in this sense means that absolutely nothing in the experiential realm of dualistic awareness has this nature of reality, in fact quantum theory indicates that Nagarjuna’s ‘tetralemma’ is correct, phenomena at the quantum level do ‘hover’ between existence and non-existence. Buddhist philosophers were deeply concerned with the knowing the ‘real’ nature of ultimate reality. Their project of attaining direct non-conceptual insight and understanding of its nature clearly required that they had a pretty good conceptual idea of its nature; and the methods of conceptual metaphysical analysis they developed gave them insights which the West only penetrated with the advent of quantum theory.

The issue of the ‘real’ nature of ‘reality’ also seems to be crucial to Fuchs’s argument as he tells us that his gripe with the notion of ‘quantum states’ is that the belief in the reality of them is the reason that ‘patching the leaking boat’ of quantum theory has become a thankless ask:

The only source of leaks was the strategy of trying to tack a preconception onto the theory that shouldn’t have been there. What is this preconception? ... The preconception is that a quantum state is a *real thing* – that there were quantum states before there were observers; that quantum states will remain even if all observation is snuffed out by nuclear holocaust.⁷

An observation which dramatises the issue of the nature of nuclear ‘reality’ perfectly!

With regard to Zurek’s ‘epiontic’ ‘quantum Darwinism’ perspective Fuchs writes that:

Zurek’s “let quantum be quantum”? It is, as far as I can tell, a view that starts and end with the wave function. There is no possibility that two observers might have two distinct (contradicting) wave functions for a system, for the observers are already *in* a big giant wave function themselves. So when I say “Why the quantum?” is the most pressing question, I mean this specifically in an interpretive background in which quantum states aren’t real in the first place. I mean it within a background where quantum states represent observer’s *personal* information, expectations, degrees of belief.⁸

So Fuchs’s notion of ‘QBism’ appears to be radically subjectivist; it seems to attempt to remove belief in anything beyond the “observer’s *personal* information, expectations, degrees of belief.” A few sentences on in his response to one of the questions asked by Maximilian Schlosshauer (What are the big issues?), in the recently published *Elegance and*

Enigma: The Quantum Interviews, Fuchs expresses his belief that “quantum theory is actually about how to structure one’s degree of belief.”⁹ And the thing which Fuchs clearly believes that it is necessary *not* to structure any degree of belief in is the universal wave function as presented by Zurek, or at least Fuchs’s understanding of Zurek. Certainly Zurek’s answer to the question as to his favourite interpretation supports Fuchs’s view of Zurek’s view. Zurek says:

I think the relative-state view of Everett (and Wheeler!), in a form which does not prejudice the interpretation by making it into “many worlds”, is the best *framework* for interpretation. It is the most flexible (and most quantum!) way to think about quantum theory and our universe.¹⁰

So Zurek accepts to a fairly high degree of belief the ‘reality’ of a universal quantum wave function of reality; whereas it seems that Fuchs has no degree of belief in such a universal ‘quantum state’.

When we turn to the section of *Elegance and Enigma* devoted to the question ‘What are quantum states?’ Zurek takes up Fuchs’s gauntlet and rushes into the quantum affray:

...one is tempted to altogether deny the existence of quantum states and reduce them to mere information in possession of the observer. But this is not completely fair ... [The] interdependence between the “objective existence” and “mere information” roles of quantum states makes it difficult for me to buy into programs that go all the way in either of these two directions.

Zurek, then, declares his intention to steer a ‘middle course’ between the two possible extreme beliefs that he identifies and makes the following criticism of the QBism perspective, which Zurek considers to be the extreme view opposite to the full-blown ‘many-worlds’ interpretation:

At the opposite end of the spectrum are attempts to derive “all of the quantum” from subjective, observer centered point of view. Naïve subjectivist approaches fail in one obvious way: the observer has to be outside of the quantum realm, so that his subjective view of the universe can be based on something firm and nonquantum. How to construct an observer who is outside the quantum realm – so that his subjective information can be the basis for the quantum world out there – from subjective quantum pieces is difficult to imagine.

Note Zurek’s characterization of the QBist viewpoint: “Naïve subjectivist approaches.” The gloves are off and we are in the midst of serious quantum controversy!

Zurek tells us that he believes that examining such ‘extreme’ views about the nature of quantum reality, on the one hand the ‘many-worlds’ view that everything possible is actual and, on the other, the QBist subjectivist view that there is nothing actual beyond subjective beliefs, is “a valuable exercise”¹¹ Zurek believes, however, that the truth of the situation “lies between the two extremes.” We can outline the possible quantum positions that have been suggested so far as follows:

- *Extreme View 1* – ‘Many Worlds’ of the universal wave function. There is an eternally existent ‘real’ wave function of reality and within this wavefunction there are ‘real’ multiple universes or worlds within which everything that is possible within the universal wave function does become really actual in some universe or world.

- *Extreme View 2 – QBism.* There is nothing inherently and absolutely existing as a ‘real’ external or underlying ‘reality’. There are only personal experiences which give rise to subjective ‘degrees of belief.’
- *Zurek’s Middle Way between extremes.* Zurek says that:

I firmly believe that pushing even such extreme points of view as many worlds or the subjectivist approach to “the quantum” is a valuable exercise. We have definitely learnt a lot from Everett and DeWitt, and we definitely learnt a great deal from Bohr, who at least some of those pursuing the subjectivist approach cite as their intellectual forefather. I believe the truth lies somewhere between these two extremes: I take from Everett the lesson that quantum theory is the best tool for explaining its own workings, but I take from Bohr (and Wheeler) the firm conviction that when we find out how it works, we will realize that information was an integral part of the machinery. (One might say that this attempt to have the best of both points of view is complementarity).¹²

Zurek’s viewpoint suggests that the situation is such that a single collective world is ‘epionically’ created within the field of potentiality of the universal quantum wave function through the operation of internal ‘subjectivist’ information processing of some sort. This viewpoint establishes a ‘middle way’ between extreme ‘objectivism’ and extreme ‘subjectivism.’

This configuration of extreme positions regarding the nature of quantum reality with a ‘middle path’ between them echoes a crucial fourteenth-fifteenth century debate within Tibetan Buddhism regarding the exact nature of the ‘ultimate’ reality of ‘emptiness’. At first sight it is indeed remarkable to find these two debates, in apparently dramatically differing areas of discourse, having such a deep similarity. However we are in fact dealing with the ‘same’ ‘ultimate’ nature of reality, as Vlakó Vedral has pointed out:

Quantum physics is indeed very much in agreement with Buddhistic emptiness.¹³

Not only do we find the same configuration of viewpoints, we also find the same passion. In his introduction to the section on ‘My Favorite Interpretation’ section of *Elegance and Enigma* Schlosshauer writes that:

And there’s no magic cure-it-all: with every interpretation, you win some but you also lose some, and whether something is to be regarded as a gain or a loss in any given instance will depend on who you ask. Two people may see one and the same aspect of a particular interpretation in starkly different lights. Take Everett’s scientific-realist reading of the wave-function formalism as an example. One person may celebrate this interpretive move as the one that lets the quantum do the talking; as the one that takes to heart the message of quantum theory in the most consistent and unadulterated manner; as the one that has no need for wasting and mincing words, for hiding behind philosophical and semantic smoke screens, for elevating man-made terms such as “irreducibly classical concepts” and “complementarity” to principles of nature. But another person may feel the exact opposite, judging the desire to promote a formal entity - the wave function - to the all-encompassing, objectively existing essence of the universe as symptomatic of a classical mindset. And they might see the Everett interpretation as possessed by a philosophical agenda

of absolutism and monism - an agenda that William James, long before Everett's time, captured thus:

So the universe has always appeared to the natural mind as a kind of enigma, of which the key must be sought in the shape of some illuminating or power-bringing word or name. That word names the universe's PRINCIPLE, and to possess it is, after a fashion, to possess the universe itself. "God," "Matter," "Reason," "the Absolute," "Energy" are so many solving names. You can rest when you have them. You are at the end of your metaphysical quest.¹⁴

With regard to the Tibetan Buddhist debates concerning the nature of ultimate reality the Buddhist scholars José Ignacio Cabezón and Geshe Lobsang Dargyay point out in their book *Freedom from Extremes – Gorampa's "Distinguishing the Views" and the Polemics of Emptiness* that:

...there are probably few cultures that have mastered the art of the polemical insult to the extent that Tibetans have. And this undoubtedly is part of what makes the genre a spectacle, and therefore what makes it popular. Tibetan polemicists sometimes claim that their opponents are under the influence of drugs, or of various diseases, or worse, that they are possessed by demons - for why else would they be babbling nonsense. They compare them to dumb animals (sheep is the preferred species). They accuse them of pride, but too stupid to know even how to boast, they do their 'dance' with "the decapitated head rather than the tail of a peacock hung from their behinds."¹⁵

Disputes within the foundations of quantum theory look quite tame in comparison!

In their introduction to the fifteenth century Tibetan Buddhist philosopher and practitioner Gorampa's Madhyamaka philosophical classic *Distinguishing the Views and Practices* Cabezón and Dargyay make a similar point to that made by Zurek concerning the usefulness of establishing the nature of extreme positions in order to find a middle course:

...polemic can be sometimes exaggerated and grotesque. It polarizes viewpoints, people and schools. But it is precisely this type of polarization – this "differentiation" – that brings great clarity to issues.¹⁶

And the views concerning the Madhyamaka ('Middle Way') concept of 'emptiness' (*shunyata*) that Gorampa deals with are:

- Those who claim that the extreme of eternalism is the Madhyamaka
- Those who claim that the extreme of nihilism is the Madhyamaka
- Those who claim that the freedom from extremes is the Madhyamaka¹⁷

By its very designation as the 'freedom from extremes', it is quite clear that the third option is the correct view for Gorampa, for he is trying to determine the 'correct' conceptual formulation for the *Madhyamaka* which is the Buddhist concept of the 'middle way between extremes'. In the following discussion I shall identify the first view of eternalism with that of the universal wave function; the second view of nihilism with QBism, and the 'freedom from extremes' may be loosely compared to Zurek's suggested 'middle path.'

Before embarking on our path towards understanding the middle path between extremes as it applies within both the discourse concerning the foundations of quantum theory and the

Buddhist metaphysics of ‘emptiness’, it is important to distinguish a point of deep differentiation between Western scientific and philosophical aims and those of a Buddhist philosopher-practitioner. The point of differentiation is found in the use of the term ‘practitioner’. In the above quote from William James the point is made that the Western metaphysical aim is that of discovering the word that “names the universe’s PRINCIPLE.” Western thought in general is in search of purely theoretical and intellectual knowledge. For Buddhist philosopher-practitioners, on the other hand, metaphysical analysis is a starting point for cultivating a direct non-conceptual nondual awareness of the ultimate nature of reality through advanced meditation techniques. According to Buddhist psycho-metaphysical doctrine it is entirely possible to generate focused meditation states which take as their object a clearly understood conceptual ‘generic image’ such as ‘emptiness’. It will be difficult for anyone who has not practiced some form of focused meditation (such as *jhana* or *lamrim*) meditation to understand the technique alluded to here for such states generate a complete unwavering focused awareness which is entirely free of distraction by intrusive thoughts. The mind is completely and unwaveringly focused on the meditation object. In the second stage of these advanced meditation methods the conceptual generic image which is focused upon dissolves and when this occurs the practitioner achieves direct non-conceptual knowledge. This is the aim of philosophizing and practice – a direct non-conceptual knowledge. Having correct and appropriate conceptual knowledge, however, is necessary in order to generate non-conceptual insight. With this in mind we can return to steering a middle course to ultimate reality.

According to Buddhist psycho-metaphysical philosophy in general the problems that human beings produce in their course through life, and at a much deeper level the actual appearance of the experiential world itself, are generated from a deep seated ‘grasping’ at phenomena as being truly existent. One way of understanding this is to consider any perception of a seemingly ‘external’ entity that a sentient being may have. Although it may appear to the being in question that the perception is just a neutral perception, according to the fundamental Buddhist worldview all perceptions on the part of unenlightened sentient beings are suffused with a deep primordial psychological investment in their reality. All sentient beings ‘grasp’ at phenomena, both external and internal, as being real. Sentient beings desperately want phenomena to be ‘real’ precisely because they crave and delight in ‘existence’. According to Buddhist thought the functioning of this deep investment and craving in the reality of reality distorts reality by giving it more reality than it actually has.

There are various aspects of this grasping which when analysed give rise to subtle distinctions within Buddhist philosophy. We shall begin by considering some distinctions in the analysis of the ultimate metaphysical structure of reality as presented by the fourteenth century Madhyamika (a practitioner of Madhyamaka) Tsongkhapa, one of the philosopher-practitioners discussed by Gorampa. As we shall see Gorampa accuses Tsongkhapa of presenting a nihilistic version of emptiness.

The *Svatantrika* (Autonomist) school of the *Madhyamaka* consider that the essential metaphysical problem is that human beings (we will exclude non human sentient beings now because they are hardly likely to indulge in this kind of analysis) believe that objects really do exist externally and independently without any dependence on the minds of observers. Objects which are completely independent of the minds of observers would be truly and *ultimately* existent. For the *Svatantrikas*, however, whilst all phenomena ultimately lack true substantial reality, seemingly external entities do have a kind of *nominal* existence because they do exist *conventionally* by dint of ‘characteristics’ which inherently and naturally exist at

the conventional, as opposed to the ultimate, level of the process of reality. According to the *Svatantrika* viewpoint as presented by Tsongkhapa, then, the emptiness of phenomena lies in their not ultimately existing independently of the minds of observers. A *Svatantrika* practitioner therefore would meditate on phenomena as *not* being separate from the observing mind. This is expressed by saying that the *object of negation* for *Svatantrika* practitioners is the existence of phenomena separate and independent of mind.

According to Tsongkhapa the *Prasangika* (Consequentialist) viewpoint is a ‘higher’ and more comprehensive understanding of emptiness because it gets at a much more subtle aspect of the emptiness of phenomena:

...the measure of something being truly existent is that it is found when the object labelled by a certain name is searched for. That is the subtle object-to-be-negated... The simple negation of such ‘truth’ – that is the truth that is not found when it is searched for by means of reasoning that is explained in the Madhyamaka texts – is emptiness; it is a non-affirming negation, and it is the ultimate philosophical viewpoint of the Madhyamaka; it is the real ultimate truth and the ultimate reality of phenomena.¹⁸

Here Tsongkhapa gives a different ‘object of negation’ for understanding emptiness, and, whilst it is possible to get a notion of what is meant by examining and pondering the viewpoint intellectually, to really understand a practitioner would also mediate by actually performing the negation in a focused meditation and holding the result in the focused meditation, thus deepening direct insight.

In order to understand this view of emptiness the *Prasangika-Madhyamaka* gives the example of a chariot as an object to be negated as being a non-empty, inherently existent entity. The chariot reasoning which searches and fails to find the inherent reality of a chariot is:

A chariot does not inherently exist because of not being its parts, not being other than its parts, not being in its parts, not being that within which its parts exist, not possessing its parts, not being the composite of its parts, and not being the shape of its parts.¹⁹

If the chariot is inherently existent then it must exist in its own right, which is to say independent of other phenomena, including its parts. This means that whereas on the conventional level the chariot and its parts are mixed together, so to speak, from the perspective of an ultimate analysis we must separate them out and treat the chariot as having its own individual and separate nature and then investigate the nature of the relationship with its parts. Suppose we ask: “Is the chariot identical to its parts?” This cannot be correct because the parts are many whilst the chariot is one. Furthermore the chariot can be viewed as a separate agent that conveys its parts when it moves. If the chariot were identical with its parts then conveyer and conveyed would be identical which is absurd. On the other hand the chariot cannot be different from its parts because if this were so the chariot would be one entity separate from its parts. We would then be able to put the chariot in one place, as it were, whilst placing its parts elsewhere. We might now ask if the chariot is in its parts or if the parts are in the chariot. For the chariot to be inherently in its parts or for the parts to be inherently in the chariot the chariot and the parts would have to be completely separate than each other. The chariot is not separate from its parts, for instance, in the same way that a box is separate and independent of its contents. The same is true if the chariot were to inherently possess its parts; the two would have to be separate just like a man who possesses a cow. But the chariot does not stand separately from its parts as would be required for these

configurations to be applicable. Such an ‘ultimate’ analysis, or reasoning in search of the ultimate existence of the chariot shows that it dissolves and is not findable as an entity in its own right.

It is clear that the *Svatantrika* and *Prasangika* versions of emptiness are subtly but definitely different. In the case of the *Svatantrika* ‘interpretation’ the experienced phenomena of conventional reality (which corresponds in terms of quantum physics to ‘classical’ reality) have a kind of ghostly basis in that they have ‘characteristics’ which are somehow ‘out there’. These ‘characteristics’, although they are not in any way identical, or even remotely like, the solid reality of materiality experienced by sentient beings, provide the basis upon which minds impute a ‘conventional’ or ‘classical’ independent world which appears to be independent of mind and minds but, in ultimate reality, is not.

The similarity of the metaphysical configuration of the *Svatantrika* viewpoint to Zurek’s notion of epiontic quantum Darwinism should be apparent. The *Svatantrika* notion of ghostly external ‘characteristics’, which are the basis for the arising of a conventional or classical world, is thoroughly analogous to Zurek’s presentation of ‘quantum states’:

...can quantum states replicate basic properties of classical states? I believe the answer is a resounding yes: the essence of this view of the emergence of the classical lies in “quantum Darwinism” - in the selective proliferation of information about certain preferred states throughout the environment. Once this happens, such information becomes effectively objective: by trying out different possible measurements on subsets of states, the observer can find out the underlying state that has spawned such a progeny. To be sure, states of the measured environment subsystems will be destroyed, but there are still plenty more copies of the original in the environment, so one can find out what that state is, by trial and error, without erasing the information that is shared by the whole set of them. So in a sense, as a consequence of quantum Darwinism one can kill a messenger without endangering the message. Moreover, as there are many copies, many observers can do this independently. It is not difficult to see that they will always agree about their findings. Thus, quantum Darwinism explains how robust objective reality - collective states that can be found out without being destroyed - can be built out of fragile quantum states.²⁰

Zurek’s ‘fragile quantum states’ are the *Svatantrika* ghostly (‘dream-stuff’) ‘characteristics’ which are the basis for the emergence of conventional or classical ‘reality’.

Fuchs’s QBism, on the other hand, corresponds more readily to the *Prasangika* version of emptiness which is a ‘non-affirming negation’, a negation of inherently existing phenomena which really does not affirm anything in place of the phenomena which has apparently been ultimately ‘reasoned’ out of existence. Recall the chariot deconstruction which leaves one hanging in, well, emptiness. This metaphysical deconstruction can be applied to all phenomena because any phenomenon can be reduced to its parts in space or time. If you think that quarks are really ultimately existing inherent bits and pieces of reality just ponder the following observation by Nobel Prize winning Frank Wilczek:

The quantum Grid, which embodies our deepest understanding of reality, requires many qubits at each point of space and time. The qubits at a point describe the various things that might be happening at that point. For example, one of them describes the probability that (if you look) you will observe an electron with spin up

or down, another the probability that (if you look) you will observe an antielectron with spin up or down, and another the probability that (if you look) you will observe a red u quark with spin up or down.²¹

So presumably the *Prasangika* deconstruction should end at the level of Wilzcek's 'quantum Grid'. But what does this Grid consist of? Zurek would surely invoke 'quantum states' at this point. Fuchs, however, has declared that "quantum states do not exist."²² According to Gorampa, Tsongkhapa's *Prasangika* version of emptiness amounts to nihilism; Fuchs is often accused of being a solipsist, an accusation he vigorously denies.

In his paper *QBism, the Perimeter of Quantum Bayesianism* Fuchs offers the cartoon image shown in figure 1 and explains its significance in elucidating QBism as follows:

In contemplating a quantum measurement, one makes a conceptual split in the world: one part is treated as an agent, and the other as a kind of reagent or catalyst (one that brings about change in the agent itself). The latter is a quantum system of some finite dimension d . A quantum measurement consists first in the agent taking an action on the quantum system. The action is represented formally by a set of operators $\{E_i\}$ - a positive operator-valued measure. The action generally leads to an incompletely predictable consequence E_i for the agent - The quantum state $|\Psi\rangle$ makes no appearance but in the agent's head; for it captures his degrees of belief concerning the consequences of his actions, and, in contrast to the quantum system itself, has no existence in the external world. Measurement devices are depicted as prosthetic hands to make it clear that they should be considered an integral part of the agent. The sparks between the measurement-device hand and the quantum system represent the idea that the consequence of each quantum measurement is a unique creation within the previously existing universe. Two points are decisive in distinguishing this picture of quantum measurement from a kind of solipsism: 1) The conceptual split of agent and external quantum system: If it were not needed, it would not have been made. 2) Once the agent chooses an action $\{E_i\}$ to take, the particular consequence E_k of it is beyond his control - that is, the actual outcome is not a product of his whim and fancy.²³

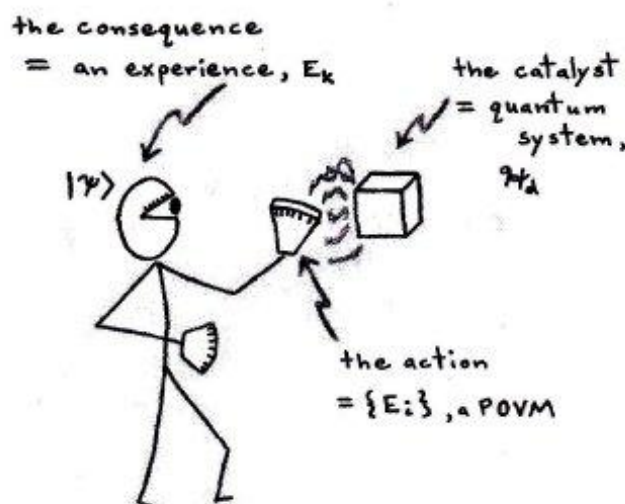


Figure 1

There are some intriguing aspects to Fuchs's derivation of his QBism perspective, wherein the quantum wave function "makes no appearance but in the agent's head" wherein it "captures his degrees of belief concerning the consequences of his actions". Fuchs tells us the quantum wave function has "no existence in the external world" but, paradoxically, the "quantum system itself" apparently does, "conceptually" speaking, have some kind of, at least provisional, 'existence' in the 'external world.'

An incongruous feature of this analysis is that Fuchs makes a provisional dichotomy into agent and the 'catalyst' quantum system in order to perform his conjuring trick of moving the quantum state or wave function from the place where it is traditionally, so to speak, located, which is where Fuchs's nebulous 'quantum system' now resides, into the agent's head. The 'quantum state' now becomes nothing but a constantly evolving personal set of 'degrees of belief.' This personal set of 'degrees of belief' arises on the basis of the set of experiences which have occurred to the particular person up until the present time. Once this perspective has been developed, however, the 'quantum system' seems to dissolve into, perhaps you guessed it, emptiness! (See figure 2). Although Fuchs refers to a putative 'quantum system' conceived of as being external to the subjectivities 'interacting' with it, in his discussion this nebulous conceptual convenience seems to entirely lack any defining characteristics. It seems, therefore, to be nothing other, if even this, than an 'empty' indefinable pool of possibility.

Results of actions builds up
set of degrees of belief

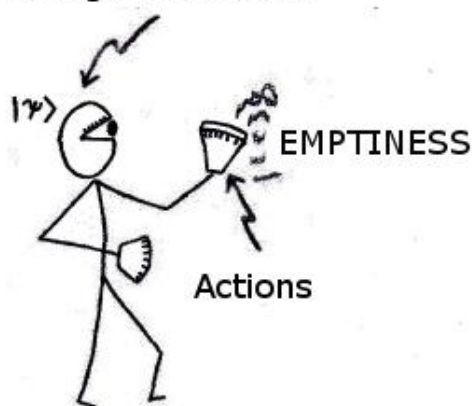


Figure 2

In the QBism perspective what appeared to be a 'quantum state', which was thought to 'exist' in some sense 'external' to the observer, now becomes a summary of the person's information input which has been acquired to date. Fuchs paraphrases a quote by James Hartle to elucidate this point:

A quantum-mechanical state being a summary of the observers' information about an individual physical system changes both by dynamical laws, and whenever the observer acquires new information about the system through the process of measurement. The existence of two laws for the evolution of the state vector becomes problematical only if it is believed that the state vector is an objective property of the

system. If, however, the state of a system is defined as a list of [experimental] propositions together with their [probability of occurrence], it is not surprising that after a measurement the state must be changed to be in accord with [any] new information. The “reduction of the wave packet” does take place in the consciousness of the observer, not because of any unique physical process which takes place there, but only because the state is a construct of the observer and not an objective property of the physical system.²⁴

The ‘two laws of evolution’ referred to here are 1) the smooth development of the wave function as it was thought to function in traditional quantum theory and 2) the ‘collapse of the wave function’ or ‘reduction of the state vector’ which appeared to occur when a ‘measurement’ takes place. These two phases are now smoothed out because there is simply nothing in the external world to which any ‘collapses’ or ‘reductions’ could take place; it’s all in the mind of the observer, of which there are, of course, many, each pursuing their own course of decision making and acquiring ‘information’ to update their quantum degrees of belief systems.

In this quantum viewpoint the ‘quantum system’ really does seem to become analogous to an infinite pool of ‘empty’ and unstructured foundationless creative potentiality which has no graspable feature whatsoever. The universe becomes a mysterious, infinitely and spontaneously creative field of ‘emptiness’, or ‘empty’ potentiality, from which experiences, including experiences of our own embodiment, magically appear as if almost from nowhere. Thus in Fuchs’s published email correspondence with colleagues we read:

For my own part, I imagine the world as a seething orgy of creation...There is no one way the world is because the world is still in creation, still being hammered out. It is still in birth and always will be...(To Sudbery-Barnum 18.8.03)

Something new really does come into the world when two bits of it [system and apparatus] are united. We capture the idea that something new really arises by saying that physical law cannot go there - that the individual outcome of a quantum measurement is random and lawless. (To Caves-Schack 4.9.S1)

A quantum world,.[is] a world in continual creation (Fuchs (2005) p.1)

There is no such thing as THE universe in any completed and waiting-to-be-discovered sense...the universe as a whole is still under construction...Nothing is completed...even the “very laws” of physics. The idea is that they too are building up in precisely the way - and ever in the same danger of falling down as - individual organic species. (To Wiseman 24.6.02)

How does the theory tell us there is much more to the world than it can say? It tells us that facts can be made to come into existence, and not just some time in the remote past called the “big bang” but here and now, all the time, whenever an observer sets out to perform...a quantum measurement...[I]t hints that facts are being created all the time all around us (To Musser 7.7.04)²⁵

The QBism perspective is a radical form of pan-experientialism:

The expectation of the quantum to classical transitionists is that quantum theory is at the bottom of things, and “the classical world of our experience” is something to be derived out of it. QBism says “No. Experience is neither classical nor quantum. Experience is experience with a richness that classical physics of any variety could

not remotely grasp.” Quantum mechanics is something put on top of raw, unreflected experience.²⁶

And within this heady vision of a dance of pure experience the act of spontaneous creativity takes centre stage:

To put it still differently, and now in the metaphor of music, a jazz musician might declare that a tune once heard thereafter plays its most crucial role as a substrate for something new. It is the fleeting solid ground upon which something new can be born. The seven tracks titled Salt Peanuts in my mp3 player are moments of novelty in the universe never to be recreated.²⁷

It seems that the Madhyamika master Nagarjuna’s answer to the riddle of the ultimate nature of existence is entirely consistent with QBism:

For those for whom emptiness is possible,
Everything is possible,
For those for whom emptiness is not possible,
Nothing is possible.²⁸

But it is important to bear in mind that Buddhist ‘emptiness’ doesn’t mean ‘nothingness’, it is an infinitely fertile realm of spontaneous creative potentiality.

In his outline derivation of the QBism perspective Fuchs tells us that for the agent involved in making a measurement “the actual outcome is not a product of his whim and fancy.” The problem, however, with this assertion is that there is absolutely nothing in the account which actually can account for the actual outcome not being “a product of his whim and fancy.” On the QBism view given by Fuchs we simply have to accept that the world is this way, it is miraculously co-ordinated such that it is not subject to whim and fancy, but we cannot query as to the source of this co-ordination. In his derivation Fuchs makes a ‘conceptual’ use of a putative ‘quantum system’ which appears to be ‘external’ to the agent but, as we have seen, this seems to be a ‘conceptual’ convenience which is as insubstantial as ‘emptiness’. For as Fuchs forcefully tells us:

...quantum states are not something out there, in the external world, but instead are expressions of information. Before there were people using quantum theory as a branch of physics, before they were calculating neutron-capture cross-sections for uranium and working on all the other practical problems the theory suggests, there were no quantum states. The world may be full of stuff and things of all kinds, but among all the stuff and all the things, there is no unique, observer-independent, *quantum-state kind of stuff*.

This viewpoint, which simply accepts a ‘conventional’ world of ‘stuff and things’ but refuses to speculate on the nature of an ontology underlying the functioning of the ‘stuff and things’ is remarkably close to the *Madhyamaka-Prasangika* view as depicted by the seventh century Madhyamika Chandrakirti:

Vases, canvas, bucklers, armies, forests, garlands, trees,
Houses, chariots, hostilities, and all such things
That common people designate, dependent on their parts,
Accept as such. For Buddha did not quarrel with the world!

Parts and part possessors, qualities and qualified, desire and those desiring,
Defined and definition, fire and fuel – subjected, like a chariot,

To sevenfold analysis are shown to be devoid of real existence.
Yet by worldly, every day convention, they exist indeed.²⁹

Here Candrakirti lists a few items of ‘stuff and things’ which appear to exist as ‘inherently real’ entities in the ‘worldly, every day convention’. These things do indeed *appear* to exist most definitely and undisputedly. However, when, like the chariot analysis which has been indicated previously, these things which are ‘dependent on their parts’ are subjected to the sevenfold analysis (an entity which is dependent on its parts does not inherently exist because 1) it is not identical with its parts, 2) it is not completely separate from its parts 3) it is not in its parts, 4) it is not something within which its parts exist, 5) it does not possess its parts, 6) it is not the composite of its parts, and 7) it is not the shape of its parts) they vanish into emptiness, they are clearly not there in the way that they appear to be:

As when you dream or see a city in the clouds,
A mirage of a pool, an optical illusion, or an image in a glass,
The things you see are unproduced, are all without existence.
But how do we perceive them? It should not be possible!³⁰

This *Prasangika* view (although it must be pointed out that the ‘*Prasangika*’ label came later within Tibetan classification, Chandrakirti would have not considered himself to be such) seems to be thoroughly consistent with QBism. When Chandrakirti says that the things of the ‘common’ conventional world are unproduced he means that they are not produced as inherently existing entities from some deeper underlying substantial cause, they literally hang in emptiness. There are just perceptions without any underlying ground of perception. The *Prasangika* Madhyamika accepts the appearance of the common world of conventionality as groundless, hanging in emptiness so to speak.

To illustrate how applicable this is to Fuchs’s perspective we can consider his treatment of the “Wigner’s friend” scenario. In the usual presentation of this quantum conundrum we consider that Wigner has left his friend to make a measurement of some quantum system and the friend keeps his result private. Wigner returns does not know the result. Now the paradox is supposed to reside in the fact that the friend, having ‘collapsed’ the wave function of the quantum system in question is happily in his quantumly collapsed state, he is not hovering in a quantum superposition of contradictory possibilities. Wigner, however, from the perspective of traditional quantum theory, must ‘see’ his friend as a hovering mist of quantumly superposed possibilities. There would seem to be a contradictory situation as to the ‘quantum state’ of the friend. This, according to Fuchs, indicates the kind of problems which arise when we take the notion of ‘quantum states’ seriously:

Who has the right state of information? The conundrums simply get too heavy if one tries to hold to an agent-independent notion of correctness for otherwise personalistic quantum states. The Quantum Bayesian dispels these and similar difficulties of the “aha, caught you!” variety by being conscientiously forthright. *Whose information? “Mine” Information about what? The consequences (for me) of my actions upon the physical system!*³¹

From this perspective there are only personalised perception, action, and belief systems (within which various beliefs have degrees of uncertainty), which presumably includes unconscious structures of degrees of belief, and, furthermore:

You see, for the QBist, the real world, the one both agents are embedded in - with its objects and events - is taken for granted. What is not taken for granted is each agent's access to the parts of it he has not touched.³²

As in the *Prasangika* version of *Madhyamaka* the perceptions of the various agents seem to hang unconnected with each other in a space-like emptiness, and yet the conventional world as it appears at a 'common level' is 'taken for granted'. Indeed, the Quantum Bayesian perspective seems to remove the very notion of physicality from within its domain:

The only substantive conceptual issue left ... is whether quantum mechanics is obligated to derive the notion of agent to whose aid the theory was built in the first place? The answer comes from turning the tables: Thinking of probability theory in the personalist Bayesian way, as an extension of formal logic, would one ever imagine that the notion of an agent, the user of the theory, could be derived out of its conceptual apparatus? Clearly not. How could you possibly get flesh and bones out of a calculus for making wise decisions? The logician and the logic he uses are two different substances - they live in conceptual categories worlds apart. One is in the stuff of the physical world, and one is somewhere nearer to Plato's heaven of ideal forms.³³

It is, however, necessary to be circumspect and perhaps slightly suspicious of some of Fuchs's philosophical ploys as he appears to want to deny a 'quantum-state-stuff' of the world at the same time as "positing quantum systems as 'real existences' external to the agent"³⁴ From a *Madhyamaka* perspective apparent entities which are conjured somehow from emptiness should not be considered to be 'real'. It seems far more appropriate to identify Fuchs's 'quantum system' with 'emptiness'.

However, the *Prasangika* flavour of emptiness does not fall into the extreme subjectivist (although not solipsist) viewpoint that appears to be central in QBism which seems to entirely eliminate any linking mechanism between the belief structures of groups of individuals. According to Fuchs:

...if ghostly spirits are imagined behind the actual events produced in quantum measurements, one is left with conceptual troubles to no end. ... there can be no such thing as a right and true quantum state, if such is thought of defined by criteria *external* to the agent making the assignment...³⁵

Buddhism, however, has as one of its core doctrines the assertion that *karma*, the universal law of cause and effect, operates on *all* levels of reality, including the manifestation of the apparently material world (the Western notion that karma is a purely moral mechanism is mistaken). Because of this all Buddhist schools of philosophy need some way to account for the operation of karma. The way in which the *Yogacara-Cittamatra* (*Yogachara-Chittamatra*) school of thought accounted for the operation was by asserting the existence of a 'ghostly' ground or foundation consciousness (*alayavijnana*). According to the *Yogacara-Cittamatra* the *alayavijnana* stream of subtle substantiality collects the traces of the activities of all sentient beings; these traces remain latent until the surrounding conditions and potentialities are such that they are manifested at a future point in time.

The *alayavijnana* is in many respects analogous to a universal wave function and one can consider that the process through which 'seeds' are karmically 'deposited' into this fundamental subtle ground of reality accounts for the potentialities within wave functions. So we may draw an analogy between the universal *alayavijnana* and Zurek's universal wave function. And the *Prasangika* viewpoint criticizes the *Yogacara-Cittamatra* notion of a

universal subtle consciousness, which is supposed to function to carry ‘seeds’ of potentiality, in a fashion quite concordant with Fuchs’s criticisms of Zurek’s position. Consider Fuchs’s remarks concerning the notion of an ‘unknown quantum state’:

The term is ubiquitous: unknown quantum states are teleported, protected with quantum error correcting codes, used to check for quantum eavesdropping, and arise in innumerable other applications. From a quantum-Bayesian point of view, however, the phrase can only be an oxymoron, something that contradicts itself: If quantum states are compendia of beliefs, and not states of nature, then the state is known to someone, at the very least the agent who holds it. But if so, then what are the experimentalists doing when they say they are performing quantum-state tomography in the laboratory? The very goal of the procedure is to characterize the unknown quantum state a piece of laboratory equipment is repetitively preparing. There is certainly no little agent sitting on the inside of the device devilishly sending out quantum systems representative of his beliefs, and smiling an experimenter on the outside slowly homes in on those private thoughts through his experiments. What gives?

Here Fuchs lampoons, in true Tibetan Buddhist style, the notion of an ‘unknown quantum state’. The point is that according to Fuchs there are no ‘ghostly’ yet subtly substantial ‘quantum-state-stuff’ entities that independently ‘exist’ somehow externally. Candrakirti criticizes the notion of a subtle realm of potentiality giving rise to actuality on similar grounds:

Potential cannot be in what is actual;
With what is not yet born it cannot be aligned.
No owner can there be of what does not exist,
Or such could be ascribed to childless women’s sons!

You say that consciousness will manifest and thus it has potential.
We say that since there is now no potential, there will be no consciousness.
Phenomena arising in a mutual dependence
Do not have true existence...

If consciousness emerges from a ripened potency already past
It will have come from a potential that’s extraneous to itself.
And since the instants of this continuity are alien to each other
Anything and everything can come from anything.³⁶

The first two lines indicate the ‘oxymoronic’ nature of the proposed viewpoint. The notion that potentialities are ‘actual’ entities is contradictory; if they are ‘actual’ then it follows they cannot be ‘potential’ exactly because they are already ‘actual’. Thus the notion of non-existent yet potential entities is like the notion of a ‘childless women’s sons’. The *Pransagika* view is simply that consciousness and that which consciousness is conscious of arise through ‘mutual dependence’, and mutually dependent entities are not truly or inherently existent. The final verse indicates that a potentiality in the past is a completely extraneous, alien and separate entity from a present consciousness. This means there is no relationship of any kind between them, therefore, if someone thinks that these two things can be related then any two things of any kind whatsoever, however different, could also be related.

Such a view, however, poses serious problems for the central Buddhist concept of karma, for how can a karmic action which has completely ceased in the past have any effect in the

present? The *Prasangikas* had a way around this problem. For them the entire process of reality could be considered as consisting of momentary flashes or pulses of apparent, yet ultimately ‘empty’, ‘existence’. Each existential pulse had a moment of arising, a moment of abiding, and a moment of disintegrating. Furthermore, for them ‘disintegratedness’ is a ‘functioning thing’ which conditioned further momentary pulses of ‘disintegratedness’; momentary pulses of ‘disintegratedness’, then, are responsible for the operation of *karma-vipaka*, or cause and effect, (the *Prasangika*’s version of a ‘quantum state’!).

Within the worldview of the *Prasangika-Madhyamaka*, then, there is a linking mechanism which can account for co-ordination and coherence within the process of reality. This does not however seem to be the case with QBism. This is indicated by Fuchs’s treatment of the Wigner situation wherein the QBism approach simply does not require co-ordination and coherence between the agents involved, however friendly they may be. Recall Fuchs’s exuberant endorsement of the QBist ‘personalist’ perspective:

*Whose information? “Mine” Information about what? The consequences (for me) of my actions upon the physical system!”*³⁷

Towards the end of his paper ‘QBism, the Perimeter of Quantum Bayesianism’ Fuchs discusses the QBist approach to quantum cosmology. He begins by citing a quote from David Deutsch concerning the necessity for the observer to be ‘inside’ the universal quantum system in the context of cosmology:

The best physical reason for adopting the Everett interpretation lies in quantum cosmology. There one tries to apply quantum theory to the universe as a whole, considering the universe as a dynamical object starting with a big bang, evolving to form galaxies and so on. Then when one tries, for example by looking in a text book, to ask what the symbols in the quantum theory mean, how does one use the wave function of the universe and the other mathematical objects that quantum theory employs to describe reality? One reads there, ‘The meaning of these mathematical objects is as follows: first consider an observer outside the quantum system under consideration’ And immediately one has to stop short. Postulating an outside observer is all very well when we’re talking about a laboratory: we can imagine an observer sitting outside the experimental apparatus looking at it, but when the experimental apparatus - the object being described by quantum theory - is the entire universe, it’s logically inconsistent to imagine an observer sitting outside it. Therefore the standard interpretation fails. It fails completely to describe quantum cosmology. Even if we knew how to write down the theory of quantum cosmology, which is quite hard incidentally, we literally wouldn’t know what the symbols meant under any interpretation other than the Everett interpretation.³⁸

Fuchs says about this that:

But this is nonsense. It is not hard to imagine how to measure the universe as a whole. You simply live in it.³⁹

According to Fuchs:

Quantum theory advises an agent to make all his probability assignments derivable from one quantum state. Write it like this if you wish:

$$|\Psi_{\text{universe}}\rangle \quad (17)$$

why not? We are swimming in this ocean called the universe, and we have to do physics from inside of it. But then all the rest of the universe is outside each of us. Eq. (17) represents an agent's catalog of beliefs for the relevant things outside. The only point here is that QBism has every bit as much right to do cosmology as any other crazy interpretation of quantum mechanics. The only difference is that QBism does it from the inside.

And he gives a cartoon illustration of a stick person 'building up' a personalized QBist universe for his or her personal use. I have added the bottommost stick person to add the necessary Buddhist foundation. As we can see Fuchs's agent is actually walling him or herself up into a private prison of personalized degrees of belief about a multitude of possibilities which then somehow carve a unique individualized field of experience of a 'universe'. In this vision each agent would have their own equation (17) so there would be a multitude of walled off personalized 'universes' (figure 4). Fuchs is accused of being a solipsist; but he is quite correct when he says that he is not, in fact he is a multiversal solipsistic pluralist!

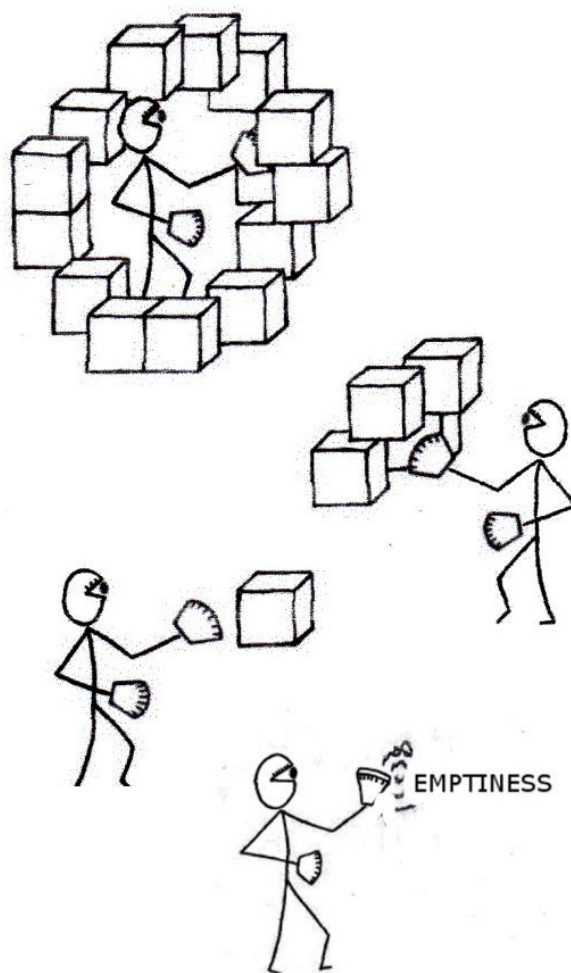


Figure 3

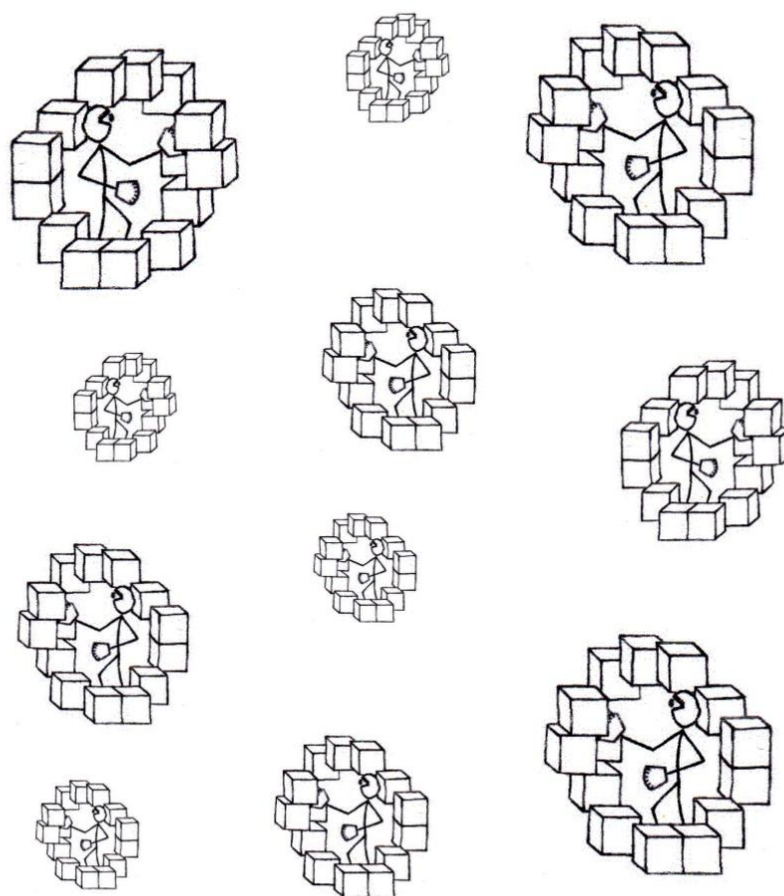


Figure 4

Fortunately for the poor solipsistic inhabitants of all these personalized universes, however, there is a way out. The belief systems which are blocking them in are all ultimately floating in ‘emptiness’ and are constructed within ‘emptiness’. So all they need to do is become ‘enlightened’ and see through the illusion that these deep seated belief systems generate. And what they need in order to do this is to ‘realize’ the fact that the blocks, representing all the experiential phenomena of the personalized universe, are ‘empty’ of ‘inherent existence’ which means that they ‘do not exist from their own side’, which is one formulation of what emptiness means. And, remarkably, in a QBist reality this is exactly true, all the blocks representing experienced phenomena in Fuchs’s cartoons are, on the basis of his own quantum interpretation, no more than the result of a systems of beliefs of various degrees of certainty or uncertainty operating within quantum emptiness!

As previously outlined the Buddhist philosopher-practitioner Gorampa (*Gorampa Sönam Sengé* 1429-1489) considered that the Tsongkhapa (*Tsong kha pa Blo bzang grags pa* – 1357-1419) version of the Madhyamaka, which is that ‘emptiness’ is realized only through a mere non-affirming negation of the inherent existence of phenomena amounts to ‘nihilism’. This is because it appears that a negation which affirms absolutely nothing would surely leave absolutely nothing. Tsongkhapa, of course, disagreed; his view was that what was left was the pure experience of emptiness which should not be described in conceptual terms. On the other extreme of the debate to Tsongkhapa is the slightly earlier Buddhist ‘master’ Dopopa (*Dol bu*

ba rab rgyal mtshan or *Dolpopa Sherab Gyaltzen* – 1292-1361). The following is Gorampa's description of Dolpopa's view which involves two interdependent types of 'emptiness'. This view begins from the perspective of Tsongkhapa's 'emptiness of own nature', which means lack of 'inherent existence':

Anything that is a conventional truth is, like a dream and an illusion, from time immemorial, empty of its own nature; that is why the emptiness of these [conventional truths] is called "emptiness of own nature." Moreover, since this form of emptiness is, by nature, but a simple absolute negation ... it is a nihilistic emptiness..., an inanimate emptiness ..., and a partial emptiness... It is not the ultimate truth - the perfect, unmistakable emptiness.⁴⁰

So, although Dolpopa agrees that Tsongkhapa's kind of 'emptiness of own nature' is an emptiness, he also asserts that it is only partial and not the whole story. According to Dolpopa the Buddhist teachings which teach only 'emptiness of own nature' only applies to conventional reality, which corresponds in the terminology of quantum theory to 'classical' reality. All the phenomena of conventional reality, which is the reality experienced by unenlightened beings, are empty of own nature, they do not have any internal solid core. However Dolpopa says of ultimate reality that:

Reality, the real, the ultimate truth, is not empty of its own nature. It is, however, empty of everything that is by nature imaginary or dependent, that is, of all compounded phenomena that are by nature conventional. This reality is the perfect, unmistakable emptiness, the ultimate truth, the *dharmakaya*, the perfect end, thusness, the emptiness that possesses the best of every quality...⁴¹

Dolpopa is aware of the necessity of Tsongkhapa's view of the 'emptiness of own nature' for the path which enables a practitioner to achieve enlightenment but when he describes the ultimate nature of reality he is famed for his assertion of its perfect stability and perfect unchangingness as the perfect nature which 'empty' of 'other' conditioned phenomena :

Just that final Buddha, the matrix of the one-gone-thus, the ultimate clear light, element of attributes, self-arisen pristine wisdom, great bliss, and partless pervader of all is said to be the basis and source of all phenomena, the void basis, and the basis pure of all defilements. It also is said to be endowed with the qualities of the body of attributes beyond the count of the sands of the Ganges River within an indivisible nature.⁴²

Dolpopa's descriptions of the ultimate nature of reality in his monumental and magnificent work on other-emptiness, *Mountain Doctrine, Ocean of Definitive Meaning: Final Unique Quintessential Instructions* are replete with phrases that resonate with the theoretical entity that modern physics calls the wave function. Some of the synonyms offered by Dolpopa, which are indicative of an appreciation of the fact that the underlying nature of the process of reality is a Mind-like field, or matrix, to use Planck's terminology ("Mind is the matrix of all matter."⁴³), of potentiality are:

- Body of attributes
- Element of attributes
- Source of attributes
- Source of all phenomena
- Basis that is empty of all phenomena
- Emptiness endowed with all aspects
- Emptiness of the ultimate

- Emptiness of specific characteristics
- Emptiness of all attributes
- Emptiness of the indestructible
- Aspectless endowed with all aspects
- Signless basic element
- Basic constituent of cyclic existence
- Pure basis
- Basis empty of all phenomena
- Limit of reality
- Limit of cyclic existence
- Limit of emptiness
- Matrix of phenomena
- The uncompounded noumenon
- Noumenon of phenomena
- Illusory like noumenon
- Self-cognizing and self-illuminating ultimate pristine wisdom
- Inconceivable sphere
- Sphere of nonduality
- Knowledge of all aspects
- Ultimate mind of enlightenment
- Natural spontaneity
- Nature of dreams
- Containing all worlds
- Buddha Matrix

The characterisations ‘body of attributes’, ‘element of attributes’, ‘source of attributes’, ‘matrix of phenomena’, ‘noumenon of phenomenon’ and ‘source of all phenomena’ and so on adumbrate what physicists consider today to be a wave function quantum realm, the realm of potentiality which exists prior to manifestation through observation. The epithet ‘containing all worlds’ indicates the close connection with the quantum many-worlds hypothesis. We might also note that the nature of this fundamental element, or matrix, of reality is described as ‘a nature of dreams,’ a designation which resonates with Zurek’s description of the quantum epiontic ‘dream stuff’ of reality.⁴⁴

Dolpopa’s elucidation of the ‘element of attributes’ states that, whilst it is fundamentally undifferentiable, at the same time all possible attributes which might be manifested are contained within it:

It also is said to be endowed with the qualities of the body of attributes beyond the count of the sands of the Ganges River within an indivisible nature.⁴⁵

And:

Just as space is asserted as always pervading all,
 So the uncontaminated Buddha-element of attributes also is asserted as always pervasive,
 Just as space pervades all forms in the sense of opening a way for them,
 So it also pervades the groups of sentient beings.⁴⁶

And:

Just as space which has a non-conceptual and unobstructed nature
 Pervades undifferentiably all physical phenomena
 So the luminous nature of mind, the primordially undefiled element of attributes,
 Also entirely pervades without differentiation all states of persons.
 That naturally pure element of attributes is the general character or noumenon of all
 phenomena...⁴⁷

And:

Dwelling in the bodies of all
 In a dual and nondual manner
 The principle essence of effective things and non-effective things.
 Abiding pervading the stable and the moving,
 It is asserted as just having the form of illusion.⁴⁸

And:

Space is the element of attributes.
 The element is thought of as 'seed.'
 It exists inside all phenomena.
 It is the cause of all supreme states.
 Just as oil exists in sesame,
 Just as fire exists in wood,
 So it exists in all phenomena.
 Though it exists in that way
 In all phenomena, it is not seen.⁴⁹

And this ultimate perfect nature, the 'source of all phenomena', is itself 'empty of other', which means that its perfect nature is not sullied or disturbed by all the conditioned phenomena of the conventional world. When this level of reality is directly experienced in deep meditation it is a unwavering blissful continuity of nondual awareness.

Dolpopa's viewpoint makes a lot of sense, and when Dolpopa's view is appreciated it is also possible to see the full relevance of Tsongkhapa's position. Figure 5 shows an unenlightened human being observing a conventional and 'classical' phenomenon which has come into apparent existence from the 'ultimate' quantum realm through the operation of the agent's belief systems which produces the appearance of the classical world. As far as this unenlightened being is concerned such appearances appear very real, the apparent solidity of the 'material' world is very persuasive. From this point of view it is Tsongkhapa's view of the 'emptiness of own nature' which is of paramount importance. In order to become enlightened a practitioner needs to 'realize' this truth directly and without any trace of doubt, enlightenment is an existential transformation of consciousness which operates at the deepest level of psychophysical embodiment. Figure 6 show the situation from the point of view of an enlightened being whose consciousness resides in the ultimate realm. Such a being, a buddha, has 'gone beyond' the conventional realm and they abide in the ultimate. From their point of view the ultimate realm is 'empty' of the apparent phenomena of the conventional realm.

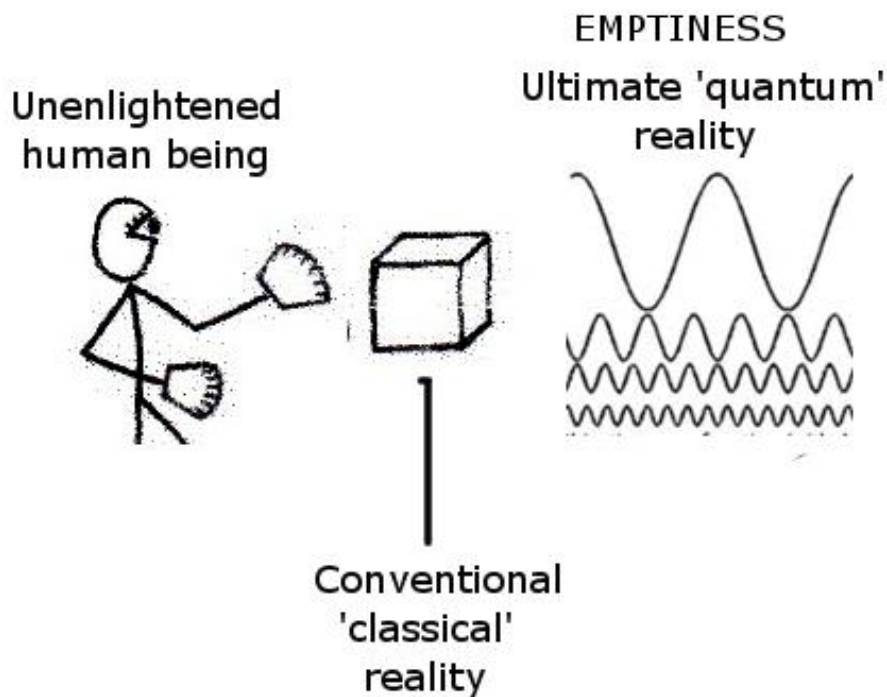


Figure 5 – Tsongkhapa’s configuration of ‘emptiness of own-nature’

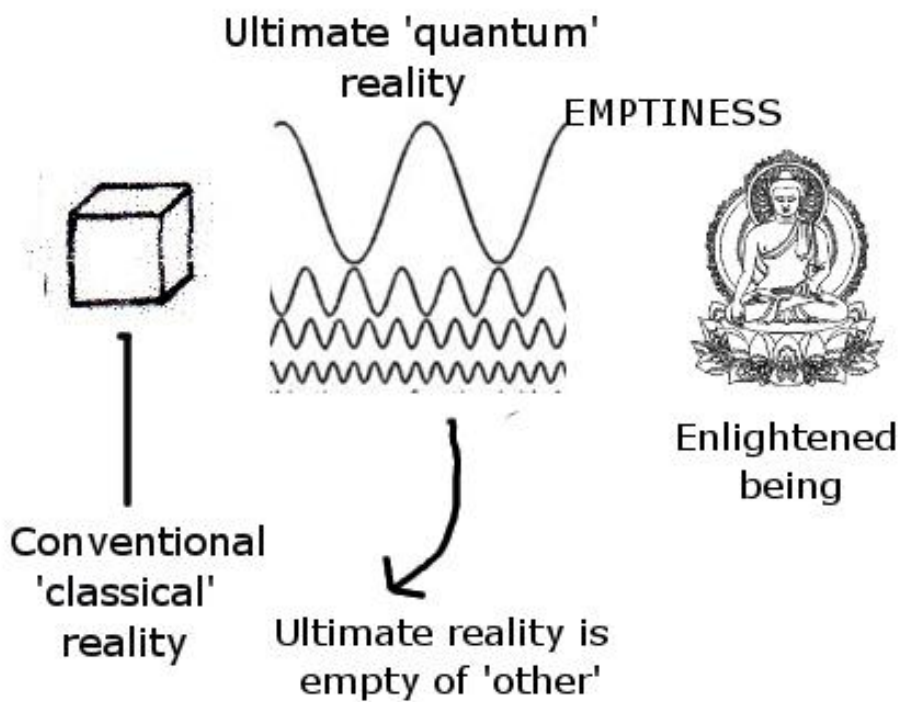


Figure 6 – Dolpopa’s configuration of ‘emptiness of other’

Gorampa, however, considers that Tsongkhapa's 'emptiness of own nature' and Dolpopa's 'emptiness of other' are extreme views and argues for a 'middle way' of 'freedom from extremes':

The third system is the view of the Madhyamaka as Freedom from Extremes, a view that has been cultivated and then explained to others as the unanimous opinion and the single melody of the scholar-practitioners of the Tibetan nation up to the time of the glorious Sa skya pa scholars...

Madhyamaka [literally, "the Middle way"] refers to the freedom from all extremes, like existence and nonexistence, and is and is-not. That is why it is necessary to eliminate all grasping at extremes and all grasping at signs. Furthermore, since the subsequent grasping at extremes will not be eliminated unless one first negates "the truth" that is the object of the grasping at truth, it is necessary to set forth the truthlessness of all things, both external and internal, by means of ... reasoning ... This is the rough object-to-be-negated ... But having negated that, there is a tendency to grasp at the very emptiness of truth as if it were a real thing Just as someone mounted on a horse may not fall off on the right side, but may still fall off on the left side; likewise, those who grasp at emptiness have not gone beyond falling into the extreme of nihilism and that is why even the grasping at emptiness must be refuted. And since grasping at things as if they were both empty and non-empty, and neither must also be refuted, no object grasped in terms of the four extremes is found. It is the nongrasping of things in any of those four ways that we call "the realization of the Madhyamaka view" But if there arises a one-sided grasping of the form, "this is the Madhyamaka view, then whether one grasps thing as empty as Tsongkhapa does or as non-empty as Dolpopa does, since one will not have gone beyond a grasping at extremes, this is not the Madhyamaka view."⁵⁰

The 'Sa skya scholars' were a particular lineage of the Sakya school of Tibetan Buddhism. Gorampa was an important Sakya scholar, Dolpopa was a founder of Jonang school and Tsongkhapa was the founder of the Gelug school. The phrase 'truthlessness of all things' refers to the lack of 'inherent existence' or 'emptiness' of all phenomena which is Tsongkhapa's position. Gorampa considers that Tsongkhapa's position veers too much in the direction of negation whilst Dolpopa errs on the side of too much affirmation. According to Gorampa's view the enlightened mind embraces all phenomena but clings or grasps at none, in other words it does not cling to even the ultimate. The enlightened mind comprehends the phenomena of the conventional world and the emptiness of the ultimate realm simultaneously. Figure 7 is a somewhat feeble attempt to portray this graphically.

We can now map the three quantum views we looked at earlier, the two 'extreme' interpretations: the objective many-worlds universal wave function, and Fuchs's subjective quantum QBism suggestion, and the quantum 'middle way' advocated by Wojciech Zurek, with the two 'extreme' *Madhyamaka* views: Dolpopa's universal 'matrix of phenomena', Tsongkhapa's subjective 'emptiness of own nature' perspective, and Gorampa's claimed correction to the Buddhist 'middle way' in his view of the 'freedom from extremes.'



Figure 6 – Gorampa’s ‘freedom from extremes’

The ‘many-worlds universal wave function’ vision of reality asserts the objective existence of the wave function. As Dieter Zeh has said:

If quantum theory appears as a ‘smokey dragon’ ..., the dragon itself may now be recognised as the universal wavefunction, greatly veiled to us local beings by the ‘smoke’ represented by our own entanglement with the rest of the world.

However you turn it: *In the beginning was the wavefunction.*⁵¹,

And presumably this means also that the end will be the wave function. And in the many-worlds flavour of the universal wave function all worlds contained within this ‘smokey dragon’ of existence ‘exist’, or are ‘real’ for the experiential continuums of the sentient beings involved, although ultimately illusory. Dolpopa’s universal ‘element of attributes’, or ‘matrix of phenomena’ is also viewed as the permanent and unchanging ‘objective’ basis for the illusory phenomena which appear within it but are in ‘reality’ not part of it. Thus for Dolpopa all the worlds of the ‘conditioned’ phenomena within his matrix are considered to be illusory whereas the basis itself is ultimate reality.

Tsongkhapa, on the other hand, adopted a viewpoint consistent with a radical subjectivist perspective because he considered that the phenomena experienced by all sentient beings were the result of the operation of two sets of internal modes of mistaken perception, the ‘afflictive obscurations’ and the ‘obstructions to omniscience’. Both of these have been built up over beginningless time through repeated rebirths. ‘Afflictive obscurations’ are the most

gross of the two, being generated by afflicted emotions such as greed and anger. ‘Obstructions to omniscience’ consist of subtle layers of deep belief that experiential phenomena are inherently real. According to Tsongkhapa when a Buddhist practitioner removes all the obscurations and obstructions they thereby realize the ‘empty’ nature of the process of reality and thus become enlightened. This view can be compared, at least in its metaphysical essence, with the subjectivist QBist perspective.

We have seen how Gorampa attempted to embrace and harmonize the two *Madhyamaka* ‘extremes’. Here’s what Zurek says about the quantum situation:

Measurement – perception – is the place where physics gets personal, where our role and our capabilities as observers and agents of change in the universe (and our limitations as entities subject to the laws of physics) are tested - or, rather, where we get put in our place. I believe that quick solutions, and I include both the Copenhagen interpretation and many worlds here, have a tendency to gloss over the real mystery, which is how do we - that is to say, how does life - fit within the quantum universe. I think we have managed to constrain the possible answers (for example, through research on decoherence), but I believe there is more to come. The virtue of the focus on quantum measurement is that it puts issues connected with information and existence at the very center. This is where they should be.⁵²

If we take the identification of ‘measurement’ with ‘perception’ that Zurek makes in the first sentence and use it in the penultimate sentence we arrive at a statement of his ‘epiontic’ quantum ‘middle way’:

The virtue of the focus on quantum perception is that it puts issues connected with information and existence at the very center. This is where they should be.

Zurek’s model suggests that it requires the ‘epiontic’ operation of a deep level of quantum ‘subjectivity’ which provides the drive towards perception, operating at levels much deeper than the higher levels of embodied consciousness, in order that the ‘objective’ probabilities within the universal wave function come into experiential ‘reality’. Thus his perspective would seem to embrace both the ‘objective’ and ‘subjective’ dimensions.

Zurek also makes the relevant observation that:

I think many of us have way too much confidence that our everyday language can capture everything that we will ever encounter in our quantum universe. Clearly (and as Bohr insisted!), it should capture whatever crosses into the classical realm. But mathematics is the language of quantum theory, and trying to translate it into everyday language is often simply impossible.⁵³

The Polish-American scientist and philosopher Alfred Korzybski, developer the theory of ‘general semantics’ coined a catchy phrase for this kind of insight, he said ‘the map is not the territory’.⁵⁴

Within Buddhist metaphysical philosophical debates it is generally accepted that the various ‘ultimate’ viewpoints are explorations of the advantages and the limitations of various ways of conceiving of the metaphysical depth of reality. As Buddhist scholar Jeffrey Hopkins says they are tools for developing the practitioners ‘metaphysical imagination.’⁵⁵ It is also generally accepted that no one view, amongst the views that are appropriate to ultimate reality (materialism for instance is definitely not appropriate), is the absolutely final and immovably correct one. The final knowledge of the nature of reality is attained by non-conceptual direct

experience. And one aspect of the ‘middle way’ is the skillful practice of being able to employ all possible views upon the ultimate nature of reality to the extent of their applicability within any context. All limited views, when grasped and reified as ultimate to the exclusion of all others, can become nothing more than obscuring misunderstandings. Only by understanding that all views are limited viewpoints upon the ultimate non-fixed and ultimately non-conceptual view can such views be correctly applied:

Attachment to one’s view and
Aversion to the views of others are nothing more than conception.
Therefore if you first overcome attachment and aggression
And *then* analyse, you will be liberated.⁵⁶

Only by appreciating the terrain from all viewpoints can its full nature be fully comprehended.

This perhaps might be a useful addition to the mindset to those involved in the debate concerning the foundations of quantum physics and the implications for our knowledge of reality. During the course of this exploration to find a ‘middle way’ the notion of ‘inherent existence’, which is a technical term – *svabhava*, ‘own-being’ or ‘innate-nature’ – used in Buddhist philosophy, has played a significant role. Although this term has a crucial central role in Buddhist analysis it actually denotes something which, according to Buddhist metaphysics, does not exist anywhere in the universe. It seems to be the case, as the physics writer Jim Baggott puts it, that:

There is simply nothing we can point to, hang our hats on and say *this is real*.⁵⁷

Or, as a Madhyamika philosopher would say the notion of a phenomenon within reality which has own internal fully established nature, an inherent core of substantial reality which exists in a completely self-contained, self-enclosed fashion is like the notion of a ‘rabbit’s horn’ or a ‘barren woman’s child.’ In this sense all phenomenon within the universe are ‘empty’ of inherent existence and, furthermore, this also indicates that all phenomena are interdependent.

Even furthermore, such a view means that in a very real sense the phenomena within the universe may actually lack any foundation; if, that is, we are searching for an *inherently real foundation*. Quantum physicist and philosopher Bernard d’Espagnat, having reached the conclusion that physics is incapable of ever unveiling the nature of a quantum ‘veiled’ reality conceived of as existing separately and independently of consciousness, suggests that insights into the nature of reality might very well come from other directions amongst which he refers to Buddhist thought which:

...rejects the notion of a ‘ground of things’ and even lays stress on the opposite notion, the one of an ‘absence of foundation’ or ‘emptiness.’⁵⁸

If this were to be the case then the notion of the ‘foundations of quantum theory’ might be slightly askew. Physicists generally consider that the hallmark of a viable physical theory is its effective mathematical formulation, but Gödel’s theorems have shown that mathematics itself lacks a solid logical foundation. So what should that tell us?

Reading through a book like the recently published set of interviews with leading quantum physicists, *Elegance and Enigma: The Quantum Interviews*, it is difficult not to come away with the impression that the great majority of physicists, to differing degrees, really are

looking for ‘inherently real’ foundations for their quantum theory. The overall impression is that most of those involved in the discussion think there are some kind of inherently real quantum nuts and bolts, so to speak, yet to be found. Thus Tim Maudlin, a professor of philosophy at Rutgers University, says:

“Fundamental principles” in physics ought to refer to the specification of an exact physical ontology (what exists) and a dynamics (how what exists behaves in space and time). Without these “principles,” one does not have a clear physical theory at all. And everything else, such as the analysis of interactions in laboratory (“measurements”), physical capacities for transmitting information, the computational power of physical systems, and so on, is understood in terms of physical constitution of things and the laws that govern the basic physical items. It is rather misleading to call this “interpretation,” or even “foundations”: it is rather a description of physics as a discipline.⁵⁹

GianCarlo Ghirardi, a professor emeritus of physics at the University of Trieste says:

I believe that quantum mechanics requires neither a reconstruction nor an interpretation. I take the position that it requires a reformulation that makes it internally and logically consistent - and, even more importantly, that allows it to account for our definite perceptions concerning macroscopic events.⁶⁰

Shelly Goldstein, professor of mathematics, physics and philosophy at Rutgers University:

And if what we extract from the fundamental principles is just plain old standard quantum mechanics, formulated in the usual textbook way, then insofar as the foundations of quantum mechanics is concerned, we will have accomplished precious little, since we still would not know precisely what it is that quantum mechanics says about physical reality.⁶¹

Anton Zeilinger, professor of experimental physics at the University of Vienna:

I expect that the ultimate reconstruction has to start from very simple fundamental principles that are intuitively clear - very much in the same way as, for example, in the general theory of relativity, where we have the equivalence principle.⁶²

The mindset is clear; it seems that there is a deep expectation that a fixed and final ‘inherently existent’ and completely self-consistent foundation is essential.

David Mermin, a professor of physics emeritus at Cornell University, on the other hand, endorses the ‘radical’ metaphysically relativistic proposal of the ‘consistent histories’ approach:

...the consistent historians elevate it to a fundamental ontological principle. Reality is multi-faceted. There can be this reality or there can be that reality, and provided you refrain from combining actualities from mutually inconsistent realities, all of the incompatible realities have an equally valid claim to actuality. This tangle of mutually incompatible candidates for actuality (associated with different “frameworks”) constitutes the no-collapse side of consistent histories. ... This multiplicity of incompatible realities reminds me of special relativity where there is time in this frame of reference and time in that frame of reference, and provided only that you do not combine temporal statements valid in two different frames of reference, one set of temporal statements is as valid a description of reality as the other.⁶³

This corresponds to what the modern Buddhist philosopher B. Alan Wallace refers to as ‘ontological relativity’ which is the metaphysical position that asserts that ‘reality’ can and does manifest in various different, although interrelated ways:

According to Einstein, the speed of light is invariant across all inertial frames of reference. Anyone anywhere traveling at any velocity always perceives light as traveling at the same speed, regardless of the direction it is traveling. Einstein's special theory of relativity pertains to inertial frames of reference traveling in straight lines at constant speeds, and in his general theory he expands this principle to include all frames of reference, whatever their speed or direction. Both theories are as much about invariants as they are about relativity. In the theory of ontological relativity there is one truth that is invariant across all cognitive frames of reference: everything that we apprehend, whether perceptually or conceptually, is devoid of its own inherent nature, or identity, independent of the means by which it is known. Perceived objects, or observable entities, exist relative to the sensory faculties or systems of measurement by which they are detected-not independently in the objective world. This is the broad consensus among psychologists, neuroscientists, and physicists.⁶⁴

This metaphysical position is basically the one advanced by Hawking and Mlodinow in their recent book *The Grand Design*:

Model-dependent realism short circuits all this argument and discussion between the realist and anti-realist schools of thought. According to model-dependent realism, it is pointless to ask whether a model is real, only whether it agrees with observation. If there are two models that both agree with observation ... then one cannot say that one is more real than another. One can use whichever model is more convenient in the situation under consideration.⁶⁵

Model-dependent realism accepts that the nature of reality is such that it necessarily manifests in differing, yet coherently interdependent, ways. Because of this some models, materialism for instance, can definitely be ruled out. In Hawking and Mlodinow's formulation the terms ‘realist’ and ‘anti-realist’ are used quite loosely for, in fact, Model-dependent realism necessarily will have to impute a lack of ‘inherent reality’ to all models. The whole metaphysical point of such a perspective is that it is the very nature of reality to manifest in a coherently coordinated variety of different ways; this is exactly what one would expect in a quantum epiontic universe. At the beginning of this article a quote from William James concerning the nature of the metaphysical quest was offered, the last paragraph of which is:

So the universe has always appeared to the natural mind as a kind of enigma, of which the key must be sought in the shape of some illuminating or power-bringing word or name. That word names the universe's PRINCIPLE, and to possess it is, after a fashion, to possess the universe itself. “God,” “Matter,” “Reason,” “the Absolute,” “Energy” are so many solving names. You can rest when you have them. You are at the end of your metaphysical quest.⁶⁶

However it appears that we may have to accept the fact that the nature of reality may be such that a constrained ‘epiontic’ metaphysical relativism, or ‘ontological relativity’ as Wallace calls it, is required within which various differing, and yet interconnected, conceptual formulations are possible, the only final ‘knowledge’ being a direct experiential non-dual awareness achieved by very few. In a sense one might say that quantum theory is not so much ‘elegance and enigma’ but demonstrates the *elegance of enigma*. The elegance is the result of the universal Mindnature exploring its multifaceted qualitative experiential potentialities. And

it is only within direct non-conceptual experience that we can possibly have any final knowledge of reality.

Recently I had a brief online discussion with the computational neuroscientist Luigi Acerbi who in his ‘Epionticity’ blog⁶⁷ has written that “reading in the same sentence words such as ‘quantum’, ‘God’ and ‘consciousness’” makes him “quite skeptical about the content of the text.” With regard to my assertion that ‘the ultimate nature of reality is mind-like’ (a proposition he designates as ‘M’) he blogged:

I do not care about the truth value of M. I simply think that at this point of human knowledge M is a vacuous, ill-defined, pointless statement, mostly confusing and misleading since it carries a lot of undesired baggage (nothing personal, I believe the same about many famous grand statements). According to various definitions of mind or matter, possibly including my own ones, the ultimate nature of reality is Mind. Good, well done. Now what? Do we have a mathematical theory of Mind, even a tentative one, that we can apply to the universe ...

To this I replied:

The answer is – one adopts a rigorous practice of meditation in order to get enlightened. Then you do not need a mathematical description of mind because you directly know the non-dual nature of fundamental awareness. In one metaphor one can say that the enlightened being becomes the mind of the universe and a mathematical description becomes irrelevant. Anyway we already have a mathematical equation of the functioning of mind – it’s called the Schrodinger equation.

Of course the Schrodinger equation is not the only equation we have of the functioning of Mind, or Mindnature. In a universe which displays ontological relativity there will be different interrelated formulations in the way that Heisenberg’s matrix mechanics and the Schrödinger equation are equivalent, or the various different flavors of string theory interpenetrate and overlap. The extent of the significance of the discovery of the Mindnature ground of reality was expressed by the physicist Henry Stapp when he wrote:

...the re-bonding [between mind and matter] achieved by physicists during the first half of the twentieth century must be seen as a momentous development: a lifting of the veil...⁶⁸

And, as Stapp has indicated on many occasions this ‘lifting of the veil’ has shown the validity of the notion of ‘free-will.’ Furthermore, further and deeper investigation reveals that human beings have ‘free will’ within a spiritual universe, the evolution of which is towards enlightenment. The finding of a new mathematical equation surely pales into insignificance when viewed in the light of the possibility of transforming one’s own consciousness towards deeper levels of universal awareness. We now know that human beings, given the right conditions, have the freedom to pursue the ultimate aim of the universe itself, which is the attainment of the farther reaches of human nature, which is buddhanature.

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